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Short Communication

Phytotoxic Effect of Seed Mycoflora Associated with the Genotypes of Foxtail Millet

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Millets constitute the major components of diet in temperate, subtropical and tropical regions. Cereals and millets that occupies a valuable place in the world's food economy also serve as carriers for transmitting the pathogens. Seed-borne microflora, especially fungi are considered to be the most serious biotic constraint that affects grain yield, quality and market value. Clarke [1] reported that about 4 per cent of the world's stored grain is lost through the activity of fungi and other microorganisms. Many of the seed-associated fungi are known to produce toxic metabolites, which ultimately result in seed deterioration during storage. However, the phytotoxic nature of seed mycoflora associated with cereals and some of the millets is well documented but the information available on phytotoxic effect of seed mycoflora associated with foxtail millet is very meagre. Hence, an attempt has been made to study the phytotoxic effect of seed mycoflora on five genotypes of foxtail millet.

Seed samples of five genotypes of foxtail millet viz., Srilaxmi, Lepakshi, Narasimharaya, Krishnadevaraya and Prasad were obtained from Regional Agricultural Research Station (RARS), Nandyala. Attempts were made to isolate fungi infecting foxtail millet genotypes. Fungi found to be dominant on seeds such as *Aspergillus flavus, A. niger, A. terreus, Penicillium citrinum, Alternaria alternata, Curvularia lunata, C. maculans, Fusarium* sp., *Rhizopus* sp. and *Mucor* sp. were initially cultured on Czapek - Dox broth for 21 days at 28±2°C and the culture filtrates were collected by filtration through Whatman No.l filter paper under aseptic conditions. These crude culture filtrates obtained were used to assay the toxic effect on seed germination, seedling vigor as indicated by seedling vigor index and seedling growth according to the method described by Ludwig [2], Patil and Padule [3] and Luke and Wheeler [4] respectively.

Phytotoxic effect of seed mycoflora on seed germination

The data on the percentage of seed germination and seedling vigor index of the genotypes of foxtail millet treated with culture filtrates of fungi are presented in Table 1. The germination percentage was hampered in almost all the cultivars and the germination failure up to 66.7 per cent has been observed with different seed-borne fungi. Among the five genotypes tested, Narasimharaya and Lepakshi were significantly affected by most of the culture filtrates of fungi. Out of ten isolates tested, *A. flavus* was highly effective, causing 66.7 per cent inhibition in seed germination and above 95 per cent inhibition in seedling vigor index (SVI) of genotypes Lepakshi and Narasimharaya. Similarly, a drastic reduction in seed germination and SVI of Lepakshi and Narasimharaya genotypes was recorded in case of *A. alternata, A. niger, A. terreus, Fusarium* sp., *C. maculans* and *C. lunata.* Contrarily, culture filtrates *of P. citrinum* showed a slight reduction in seed germination of some of the genotypes and a marked reduction in SVI of all the cultivars.

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Table 1. Effect of culture filtrates of seed-borne fungi on seed germination, seedling vigor and seedling growth of foxtail millet genotypes

Fungi	Seed germination (%)					Seedling vigor index					Root length (mm)					Shoot length(mm)				
	L*	S*	P*	N*	K*	L	S	P	N	K	L	S	P	N	K	L	S	P	N	K
Aspergillus flavus	33.3	93.3	79.0	33.3	86.1	16.3	210.7	125.0	58.2	252.5	4.1	4.7	3.8	3.3	5.0	5.2	8.4	7.9	4.4	7.6
A. niger	73.3	93.3	79.0	60.0	86.6	71.0	185.2	110.6	85.9	234.1	6.2	10.9	12.1	3.2	3.5	6.0	30.4	13.0	15.0	17.7
A. terreus	46.6	82.5	68.3	40.0	57.6	158.1	230.3	199.2	107.7	209.2	7.6	7.0	6.6	12.0	9.1	23.5	27.1	16.3	8.3	24.0
Penicillium citrinum	93.3	93.3	93.3	100	86.6	526.8	451.4	460.8	486.0	549.4	20.1	21.9	19.0	13.2	16.1	27.3	28.6	23.8	27.4	24.1
Curvularia maculans	73.3	50.4	79.0	40.0	64.6	263.4	159.7	170.3	221.2	285.0	9.0	27.2	3.7	9.0	4.3	30.1	18.6	25.4	22.2	27.5
C. lunata	80.0	71.8	57.6	53.3	68.3	307.0	277.8	258.9	197.9	339.2	8.5	9.0	7.8	6.6	7.4	25.0	30.6	21.0	21.7	23.1
Alternaria alternata	53.3	64.6	68.3	33.3	68.3	357.6	204.9	379.1	197.9	398.8	7.2	7.0	6.4	5.3	6.8	20.7	22.6	18.8	17.5	18.0
Fusarium sp.	60.0	79.0	50.4	42.0	57.6	417.4	462.9	400.3	174.6	446.5	5.4	6.2	5.0	4.5	4.7	13.2	14.4	11.3	9.1	11.0
Rhizopus sp.	80.0	86.1	86.6	73.3	86.6	450.8	476.8	451.8	445.3	488.7	18.8	22.6	16.4	15.3	15.9	26.8	26.7	24.7	21.2	26.0
Mucor sp.	100	93.3	79.0	100	86.1	556.2	577.5	507.4	502.0	498.5	23.9	26.6	21.2	21.9	24.6	29.3	30.1	28.5	24.3	29.4
Control	100	93.3	93.3	100	93.3	1013.0	1157.2	686.6	1455.0	1083.5	24.0	27.8	23.8	27.3	28.7	40.5	44.3	41.5	36.7	40.6

*L - Lepakshi, S - Srilaxmi, P - Prasad, N - Narasimharaya, K - Krishnadevaraya

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Germination as well as SVI of genotype Srilaxmi was severely affected by the culture filtrates of *C. maculans* whereas in Krishnadevaraya genotype, the germination was highly affected by *A. terreus* and *Fusarium* sp. and SVI by *A. terreus* in comparison with other tested culture filtrates and control. In case of genotype Prasad, reduction in seed germination with *Fusarium* sp. and *C. lunata* was 42.9 per cent and 35.7 per cent respectively, while its SVI was drastically affected (up to 83.9%) in *A. niger* treatment. Other fungi such as *Rhizopus* sp. and *Mucor* sp. were less toxic to the genotypes tested.

Phytotoxic effect of seed mycoflora on seedling growth

It is clearly evident that the culture filtrates of fungi adversely affected the root elongation in all the genotypes of foxtail millet and the percentage reduction up to 88.2 was noticed with some fungi (Table 1). Of the five genotypes, Narasimharaya and Krishnadevaraya were drastically affected by the fungal culture filtrates. A great reduction in root elongation (above 80%) was recorded in all the genotypes tested with culture filtrates of *A. flavus.*

Among the ten fungi tested, *A. niger* restricted root elongation to a maximum extent in Narasimharaya and Krishnadevaraya genotypes. *C. maculans, Fusarium* sp., *Mucor* sp. and *Rhizopus* sp. were also inhibitory to Krishnadevaraya, Narasimharaya and Prasad genotypes. Fungi such as *A. terreus, P. citrinum, C. lunata* and *A. alternata* also hampered root elongation of all the genotypes.

The culture filtrates of all the fungi hampered the shoot elongation to a greater extent and the extent of loss in different genotypes varied from 25.3 to 88 per cent. Out of five genotypes tested, Srilaxmi and Lepakshi seemed to be less affected in most of the cases while the genotype Narasimharaya was severely hindered with *A. flavus, A. terreus, Rhizopus* sp., *Mucor* sp. and *Fusarium* sp.

A. niger reduced the shoot elongation of Lepakshi genotype up to 85.1 per cent while *C. maculans* was more inhibitory to Srilaxmi and least to Lepakshi. The culture filtrates of *C. lunata* and *P. citrinum* affected the shoot elongation of genotype Prasad drastically whereas with *A. alternata,* inhibition was relatively more in Krishnadevaraya genotype. As in root elongation studies, shoot elongation of all the genotypes was suppressed to more than 80 per cent by toxic metabolites of *A. flavus* and exhibited least inhibition in case of *Mucor* sp.

In general, the effect of culture filtrates of different fungi varied depending on the genotype of foxtail millet. The differential deteriorative ability of seed mycoflora may be due to production of different types of secondary metabolites and these toxic compounds perhaps may be the main cause for reduction in seed germination and seedling growth as suggested by Vidhyasekaran *et al.* [5] and Vijayalakshmi [6]. The present results are in conformity with the findings of Pandey *et al.* [7], Shang [8] and Narasimhudu and Subbayya [9]. Kumar *et al.* [10] observed significant reduction in seed germination and seedling growth of gram seeds by 2000 mg of aflatoxin B_1/litre and this loss might be attributed to the inhibition of some enzymes and growth hormones of seeds during germination. In paddy, Vidhyasekaran *et al.* [5] also suggested that inhibition of root elongation was found to be a better criterion than shoot elongation and percentage germination. However, Abul Baki and Anderson [11], Kumar *et al.* [12] and Purushotham *et al.* [13] reported that seed germination and seedling growth are two independent traits that should be considered for phytotoxicity.

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